PTO 06-6739

Japanese Kokai Patent Application
No. Hei 11[1999]-134795

MULTI-CHANNEL RECORDING METHOD, MAGNETO-OPTICAL DISK DRIVE AND MAGNETO-OPTICAL DISK

Koichi Tada and Yoichi Tsuchiya

UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. SEPTEMBER 2006
TRANSLATED BY THE MCELROY TRANSLATION COMPANY

JAPANESE PATENT OFFICE
PATENT JOURNAL (A)
KOKAI PATENT APPLICATION NO. HEI 11[1999]-134795

Int. Cl.[6]:	G 11 B 20/10 20/00 H 04 N 5/92
Filing No.:	Hei 9[1997]-297277
Filing Date:	October 29, 1997
Publication Date:	May 21, 1999
No. of Claims:	6 (Total of 8 pages; OL)
Examination Request:	Not filed

MULTI-CHANNEL RECORDING METHOD, MAGNETO-OPTICAL DISK DRIVE AND MAGNETO-OPTICAL DISK

[Fukusu channeru kiroku hoho, hikarijiki deisuku doraibu oyobi hikarijiki deisuku]

Inventors:	Koichi Tada and Yoichi Tsuchiya
Applicant:	Sanyo Electric Co., Ltd.

[There are no amendments to this patent.]

Claims

1. A multi-channel recording method characterized by the following facts: the information of N (natural number of 2 or more) channels is compressed at a compression rate N or more times the standard compression rate; the compressed information of N channels is formed as one channel, and is recorded at the standard recording density.

2. The multi-channel recording method described in Claim 1, characterized by the fact that said information formed as one channel is classified to recording blocks in a prescribed recording unit.

3. The multi-channel recording method described in Claim 2, characterized by the fact that each said recording block contains channel identification information.

4. The multi-channel recording method described in Claim 3, characterized by the fact that said recording is performed for a disk.

5. A type of magneto-optical disk drive characterized by the fact that it performs said recording on a magneto-optical disk using the multi-channel recording method described in any of Claims 1-4.

6. A type of magneto-optical disk characterized by the fact that said recording is performed using the multi-channel recording method described in any of Claims 1-4.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a multi-channel recording method for recording information of plural channels.

[0002]

Prior art

In the prior art, as a peripheral storage device for a computer, there is a device for reproduction of information from an optical disk with high storage capacity, such as CD-ROM (Compact Disk as Read-Only Memory), MO (Magneto-Optical disk), or the like, and for recording information to said optical disk.

[0003]

In said optical disk, data is recorded by means of variation in the shape on the recording surface or variation in the magnetism on the recording surface of the optical disk. Then, the recorded data are reproduced by irradiating a laser beam on the recording surface of the optical disk and detecting the reflected light.

[0004]

In recent years, with progress in the efforts to further increase the density of information recorded on an optical disk and the demands on recording/reproduction of video/audio information, progress has been made in standardization of new magneto-optical disks, such as DVD-RAM (Digital Video Disk-Random Access Memory), AS-MO (Advanced Storage-Magneto-Optical disk), etc. For the DVD-RAM, each optical disk can store 2.6 GByte of data. On the other hand, each AS-MO measuring 12 cm in diameter and 1.2 mm thick, can store 6 Gbyte of data.

[0005]

For AS-MO, just as MO of the conventional ISO standard, data are recorded on the optical disk having magnetism using the heat of a laser beam and an external magnetic field. The magnetism recorded corresponding to the data on the optical disk having magneto-optical effect is detected by means of a laser beam to reproduce the data. In order to indicate the site (address) on the recording surface of the optical disk that stores the data, the following measures are taken: for MO, the shape and configuration of the holes formed on the recording surface of the optical disk are changed; for AS-MO, the shape of the groove formed on the recording surface is changed. That is, for MO, a bit row indicating the address information is formed, and, for AS-MO, wobbles are formed to indicate the address information on the wall surface composed of lands and grooves. Also, while data are recorded only on the lands for MO, data are recorded on both lands and grooves for AS-MO. Due to this difference in structure from MO, AS-MO can perform recording at a higher capacity.

[0006]

Problems to be solved by the invention

For said DVD-RAM and AS-MO with high storage capacity, due to development of overwrite technology, high-speed access technology, etc., the time for recording/reproduction of information has been shortened. However, at present, said optical disks are still not used effectively except as external storage devices for a computer.

[0007]

On the other hand, in the prior art, the user can make use of a videotape recorder to record the information corresponding to the program from 1 channel of a television broadcast, satellite broadcast, etc. However, at present, as communication media have rapidly developed and the communication information is high quality, the user may want to record plural channels of programs. In such case, in order to obtain the information of plural channels of programs, the user has to own plural information recorders.

[0008]

The objective of the present invention is to solve the aforementioned problems of the prior art by providing a multi-channel recording method characterized by the fact that it allows the user to record the information conveniently by means of an information recorder that can perform high-speed recording at large quantity.

[0009]

Means to solve the problems

Claim 1 of the present invention provides a multi-channel recording method characterized by the following facts: the information of N (natural number of 2 or more) channels is compressed at a compression rate N or more times the standard compression rate; the compressed information of N channels is formed as one channel, and is recorded at the standard recording density.

[0010]

According to the invention described in Claim 1, at a compression rate N or more times the standard compression rate, the information of N channels is compressed, and the compressed information of the N channels is formed as one channel that is recorded at the standard recording density. As a result, the user manipulates the information recorder that makes use of the multi-channel recording method, so that it is possible to record plural channels of information. As a result, the user can record the information more conveniently.

[0011]

The invention described in Claim 2 pertains to the multi-channel recording method described in Claim 1, characterized by the fact that said information formed as one channel is classified to recording blocks in prescribed recording unit.

[0012]

According to the invention described in Claim 2, the information of N channels is compressed at a compression rate N or more times the standard compression rate, and the compressed information of N channels is formed as one channel and is recorded at the standard recording density classified to recording blocks in a prescribed recording unit. As a result, the user can record the information of plural channels by manipulating the information recorder using said multi-channel recording method. As a result, the user can record the information more conveniently.

[0013]

The invention described in Claim 3 pertains to the multi-channel recording method described in Claim 2, characterized by the fact that each said recording block contains channel identification information.

[0014]

According to the invention described in Claim 3, the information of N channels is compressed at a compression rate N or more times the standard compression rate; the compressed information of N channels is formed as one channel and is classified to recording blocks in a prescribed recording unit, and the information is recorded together with the channel identification information at the standard recording density. As a result, the user can manipulate the information recorder using said multi-channel recording method to record the information of plural channels. Consequently, the user can record the information more conveniently.

[0015]

The invention described in Claim 4 pertains to the multi-channel recording method described in Claim 3, characterized by the fact that said recording is performed to a disk.

[0016]

According to the invention described in Claim 4, the information of N channels is compressed at a compression rate N or more times the standard compression rate; the compressed information of N channels is formed as one channel and is classified to recording blocks in a prescribed recording unit, and the information is recorded together with the channel identification information at the standard recording density on the disk. As a result, the user can manipulate the information recorder using said multi-channel recording method to record the information of plural channels. Consequently, the user can record the information more conveniently.

[0017]

The invention described in Claim 5 pertains to a type of magneto-optical disk drive characterized by the fact that it performs said recording on the magneto-optical disk using the multi-channel recording method described in any of Claims 1-4. As a result, the user can record the information more conveniently.

[0018]

According to the invention described in Claim 5, when the user operates the magneto-optical disk drive using the multi-channel recording method, the information of plural channels can be recorded. In this way, the user can record information more conveniently.

[0019]

The invention described in Claim 6 pertains to a type of magneto-optical disk characterized by the fact that said recording is performed using the multi-channel recording method described in any of Claims 1-4.

[0020]

According to the invention described in Claim 6, the user can make use of the multi-channel recording method to perform recording on the magneto-optical disk, so that the information of plural channels can be recorded. As a result, the user can record the information more conveniently.

[0021]

Embodiment of the invention

In the following, an explanation will be given regarding the magneto-optical disk player using the multi-channel recording method as an embodiment of the present invention.

[0022]

Figure 1 is a block diagram schematically illustrating the constitution of the magneto-optical disk player using the multi-channel recording method as an embodiment of the present invention.

[0023]

This magneto-optical disk player contains the following parts for recording the information corresponding to the program: antenna (1) for obtaining the information corresponding to the program from a television broadcast, satellite broadcast, etc., tuners (2)-(4) for simultaneous reception of plural pieces of information from antenna (1), MPEG encoders (6)-(8) that are connected to tuners (2)-(4), respectively, for encoding the received information to the MPEG format, controller (5) for controlling said MPEG encoders (6)-(8), memory controller (9) that controls the memory (not shown in the figure) and adjusts the timing for recording on magneto-optical disk (12) rotated by motor (13) at a constant velocity, and encoder (10) that forms the data of 3 channels from memory controller (9) to one channel and modulates it, and controls magnetic head (11) and optical pickup (14) to convert the data to the signal for recording on magneto-optical disk (12).

[0024]

Also, in order to perform reproduction of the information corresponding to the program, said magneto-optical disk player has the following parts: head amplifier (15) that amplifies the reproduction signal from optical pickup (14) to a signal [level] appropriate for treatment in the latter stages, decoder (signal processor) (16) that decodes the signal formed as one channel from head amplifier (15) to the data of 3 channels, memory controller (17) that adjusts the flow of the data reproduced from magneto-optical disk (12) that is rotated by motor (13) at a constant velocity, demultiplexer (18) that separates the multiplexed video signal and audio signal, MPEG video decoder (19) for decoding the video signal in MPEG format, on-screen display circuit (20) for synthesis of decoded video signal and text information, NTSC/PAL signal generator (21) for generating NTSC/PAL signal from said synthesized video signal, MPEG audio decoder (22) for decoding the audio signal in MPEG format, and CPU (23) that controls said various parts.

[0025]

When the information corresponding to the program is recorded, operation is performed as follows in the present magneto-optical disk player: the information corresponding to the program received via antenna (1) by tuners (2)-(4) is encoded to data in the MPEG format by means of MPEG encoders (6)-(8) controlled by controller (5), and the data are sent to encoder (10) based on the control of memory controller (9). Encoder (10) forms the data of the 3 channels as one channel and modulates it, controls magnetic head (11) and optical pickup (14), and the information corresponding to the 3 channels formed to one channel is recorded on magneto-optical disk (12).

[0026]

On the other hand, when the information corresponding to the programs recorded on the magneto-optical disk as explained above is reproduced, the present magneto-optical disk player performs the following operation: the signal formed to one channel and obtained under control of optical pickup (14) is demodulated as the data of the 3 channels by decoder (signal processor) (16) via head amplifier (15), and the data are temporarily stored in a memory (not shown in the figure) controlled by memory controller (17). Based on control by memory controller (17), the 1-channel data instructed by the user is sent to demultiplexer (18), and, by means of demultiplexer (18), the signal is separated to multiplexed video signal and audio signal.

[0027]

The video signal separated by demultiplexer (18) is treated by MPEG video decoder (19), on-screen display circuit (20) and NTSC/PAL signal generator (21), and the picture is

reproduced. Also, the audio signal separated by demultiplexer (18) is decoded by MPEG audio decoder (22), and the sound is reproduced.

[0028]

As shown in Figure 1, the information corresponding to the recorded programs is taken as that of 3 channels, and, corresponding to these channels of information, the tuners and MPEG encoders are each prepared with 3 units. On the other hand, as shown in Figure 2, the number of tuners and MPEG encoders and the compression rate of the corresponding information are set by controller (5) corresponding to the number of channels set by the user.

[0029]

For said tuners and MPEG encoders, as the user set the number of channels as 3, they are selected from the plural (more than 3) units of tuners and MPEG encoders equipped with the magneto-optical disk player. The tuners and MPEG encoders of the remaining units are not shown in the figure. For example, it is possible to set 10 units of tuners and MPEG encoders in the magneto-optical disk player. In this case, the remaining 7 units of tuners and MPEG encoders are not shown in Figure 1.

[0030]

In the following, an explanation will be given in more detail regarding the procedure of recording of the plural channels with the magneto-optical disk player with said constitution.

[0031]

Figure 2 is a flow chart illustrating the recording procedure for the information of plural channels performed by this magneto-optical disk player. Figure 3 is a diagram illustrating the data of plural channels (in this example, the data of 3 channels) generated as a sequence of data in the memory by means of memory controller (9).

[0032]

When the information of plural channels is recorded with this magneto-optical disk player, first of all, in step S1, CPU (23) (see Figure 1) sets the bit rate (data transfer rate) from the MPEG encoder to magnetic head (11) at 12 Mbps from the standard MPEG compression rate range of 10-12 Mbps. Here, the bit rate is set at 12 Mbps. However, it is also possible to set it at other values.

[0033]

Then, in step S2, the fact that the number of channels for reception is set at 3 by the user is transmitted by CPU (23) to controller (5). Based on this fact, in step S3, controller (5) selects MPEG encoders (6)-(8) as shown in Figure 1, and sets the MPEG compression rate.

[0034]

When data are compressed with MPEG encoders (6)-(8), in step S1, the bit rate from the MPEG encoder to magnetic head (11) is set at 12 Mbps, and the number of channels received in step S2 is set at 3. As a result, the MPEG compression rate for each channel is set at 4 (=12/3) Mbps by dividing the bit rate from MPEG encoders (6)-(8) to magnetic head (11) by the channel number.

[0035]

Then, in step S4, the information of the 3 channels set by the user is sent through antenna (1) to tuners (2)-(4), and reception is started. In step S5, the information sent to tuners (2)-(4) is compressed by MPEG encoders (6)-(8) at the compression rate set in step S3. In step S6, the data compressed in step S5 are sent to memory controller (9), and the data of 3 channels are compiled to a sequence of data.

[0036]

As shown in Figure 3, for the data of the 3 channels, with MPEG encoders (6)-(8), the compressed data of 1 channel are classified to the data composed of blocks in the prescribed unit, and the data of the various blocks are set sequentially to form a sequence of data. Also, each of the blocks in the data formed as one channel has the identification data for identification of each channel when resetting to the 3-channel information added to it.

[0037]

In step S7, the sequence of data are sent to encoder (10), where the error correction code is added and modulation is performed. In step S8, the modulated data are recorded through magnetic head (11) and optical pickup (14) on magneto-optical disk (12). Here, recording on magneto-optical disk (12) is performed on a disk with radius of 12 cm, with storage capacity of 6 Gbyte, track pitch of 0.6 μm, and the shortest bit length of 0.235 μm. As this treatment comes to an end, the recording treatment finishes.

[0038]

As explained above, in the present magneto-optical disk player, the tuners and MPEG encoders needed for receiving the information of the plural channels set by the user are selected, and, the compression rate of the MPEG encoders is set corresponding to the number of channels. As a result, it is possible to receive the information of the plural channels and record on the optical disk, and the information of the one channel assigned by the user can be reproduced.

[0039]

In the above, explanation has been made on reproduction of the information of one channel with reference to Figure 1. In the following, an explanation will be given regarding simultaneous reproduction of the information of plural channels.

[0040]

Figure 4 is a block diagram schematically illustrating the constitution of the magneto-optical disk player that performs simultaneous reproduction for the information of plural channels.

[0041]

In order to perform reproduction of the information of the plural channels (3 channels in this example), said magneto-optical disk player has the following parts: head amplifier (15) that amplifies the reproduction signal from optical pickup (14) to a signal [level] appropriate for treatment in the latter stages, decoder (signal processor) (16) that decodes the signal formed as one channel from head amplifier (15) to the data of the plural channels, memory controller (27) that controls the memory (not shown in the figure) that temporarily stores the data for adjusting the flow of the data reproduced from magneto-optical disk (12) that is rotated by motor (13) at a constant velocity, demultiplexers (28)-(30) that are connected corresponding to the number of channels of the reproduced programs and separate the multiplexed video signal and audio signal, MPEG video decoders (31)-(33) for receiving the data from demultiplexers (28)-(30) and decoding the video signal in MPEG format, display controller (34) that synthesizes the decoded video signals and controls the display, on-screen display circuit (35) for synthesis of the video signal and text information, NTSC/PAL signal generator (36) for generating an NTSC/PAL signal from said synthesized video signal, MPEG audio decoders (37)-(39) for receiving the data from demultiplexers (28)-(30) and decoding the audio signal in MPEG format, and audio output selector (40) for selecting the audio signal corresponding to one sound to be reproduced from the plural decoded audio signals.

[0042]

Here, the constitution shown above is such that three units are connected from memory controller (27) for each of the demultiplexers, MPEG video decoders, and MPEG audio decoders. They are for reproduction of the information corresponding to the programs of the 3 channels. They are selected from the plural (more than 3) demultiplexers, MPEG video decoders and MPEG audio decoders, while the remaining demultiplexers, MPEG video decoders and MPEG audio decoders are not shown in the figure. For example, it is possible to set 10 demultiplexers, MPEG video decoders and MPEG audio decoders in the magneto-optical disk player. In this case, the remaining 7 demultiplexers, MPEG video decoders and MPEG audio decoders are not shown in Figure 4.

[0043]

As explained above, for the present magneto-optical disk player, when the programs recorded in the magneto-optical disk are reproduced, the signal formed as one channel obtained by means of control of optical pickup (14) is demodulated as the data of 3 channels by means of decoder (signal processor) (16) via head amplifier (15), and the data are temporarily stored in the memory (not shown in the figure) controlled by memory controller (27). Based on control of the memory controller (27), the data of the 3 channels temporarily stored in the memory are sent to respective demultiplexers (28)-(30), and they are separated to the multiplexed video signal and audio signal by demultiplexers (28)-(30).

[0044]

The video signals of 3 channels separated by demultiplexers (28)-(30) are decoded by MPEG video decoders (31-33) and are synthesized by display controller (34), and they are treated by on-screen display circuit (35) and NTSC/PAL signal generator (36) and the pictures are reproduced. Also, the audio signals of 3 channels separated by demultiplexers (28)-(30) are decoded by MPEG audio decoders (37)-(39), and the sound of one channel corresponding to the program assigned by the user is selected by audio output selector (40) and is reproduced.

[0045]

As explained above, in the present magneto-optical disk player, the tuners and MPEG encoders needed for receiving the information of plural channels set by the user are selected, and the compression rate of the MPEG encoders is set corresponding to the number of channels. Also, the information of the plural channels is formed as one channel for recording, so that the information of the plural channels is received and can be recorded on the optical disk, so that it is possible to perform reproduction of the plural channels.

[0046]

In the present embodiment, the information composed of plural video and audio signals is obtained from television broadcasts, satellite broadcasts, or the like. However, the present invention also can be adopted in the following cases: by connecting plural security cameras, etc., plural pieces of information are obtained, and they are recorded in the device.

[0047]

Also, in the present embodiment, data recorded on the optical disk are taken as continuous. However, it is also possible to perform intermittent data recording by controlling the memory controller.

[0048]

Effects of the present invention

As explained above, by adopting the multi-channel recording method of the present invention in the information recorder that can perform large capacity high-speed recording, the user can manipulate the information recorder to record the information of plural channels, so that the user can record the information conveniently.

Brief description of the figures

Figure 1 is a block diagram schematically illustrating the constitution of the magneto-optical disk player using the multi-channel recording method as an embodiment of the present invention.

Figure 2 is a flow chart illustrating the procedure for recording the information of plural channels using the magneto-optical disk player of the present invention.

Figure 3 is a diagram illustrating the data of plural channels generated as a sequence of data in the memory by means of memory controller (9).

Figure 4 is a block diagram schematically illustrating the constitution of the magneto-optical disk player for simultaneous reproduction of the information of plural channels.

Explanation of symbols

1 Antenna
2-4 Tuner
5 Controller
6-8 MPEG encoder
9 Memory controller

10 Encoder
11 Magnetic head
12 Magneto-optical disk
13 Motor
14 Optical pickup
15 Head amplifier
16 Decoder
17 Memory controller
18 Demultiplexer
19 MPEG video decoder
20 On-screen display circuit
21 NTSC/PAL signal generator
22 MPEG audio decoder
23 CPU

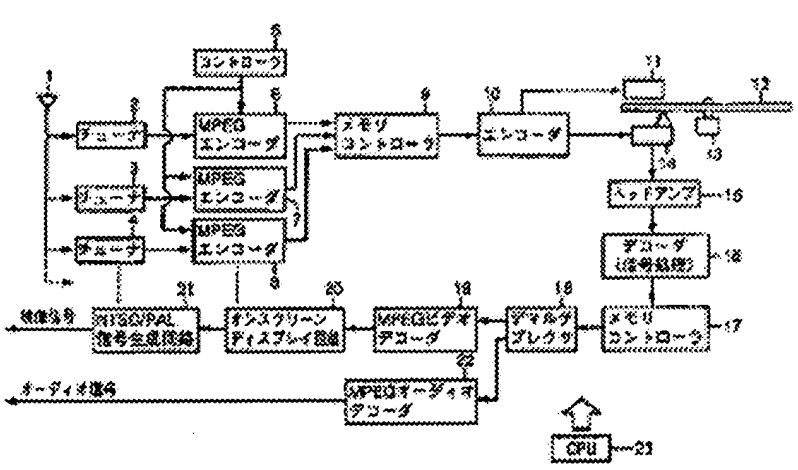

Figure 1

Key:
a Video signal
b Audio signal
1 Antenna
2-4 Tuner
5 Controller
6-8 MPEG encoder
9 Memory controller
10 Encoder
15 Head amplifier

16 Decoder (signal processor)
17 Memory controller
18 Demultiplexer
19 MPEG video decoder
20 On-screen display circuit
21 NTSC/PAL signal generator
22 MPEG audio decoder

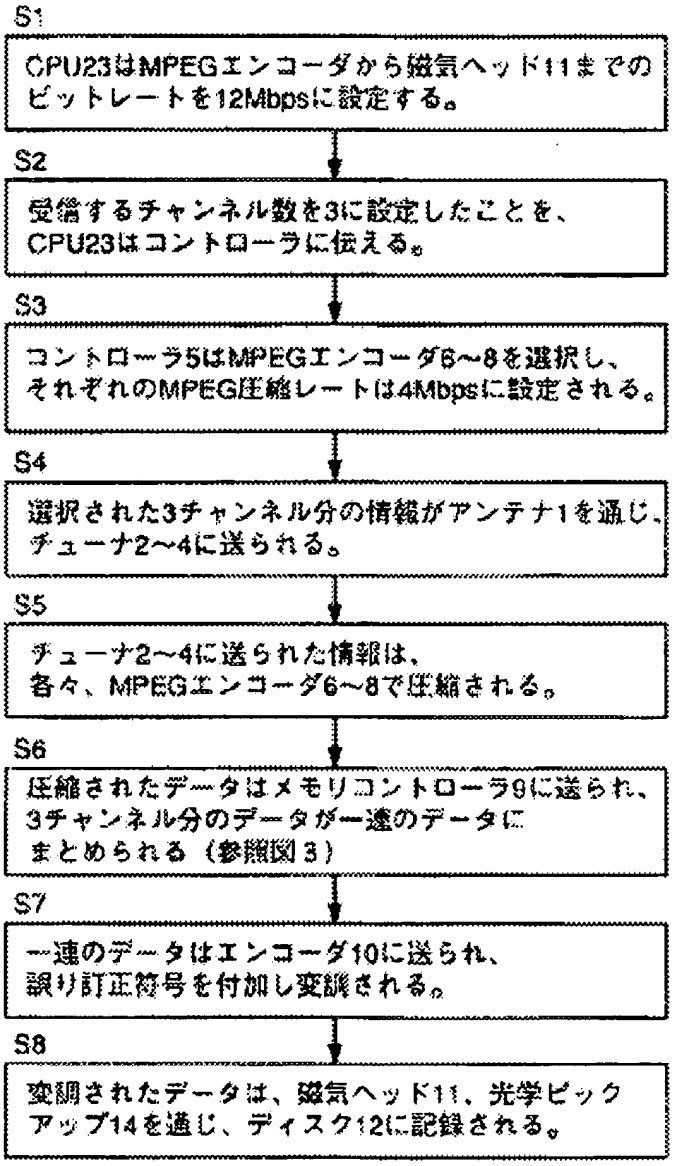

Figure 2

Key: S1 CPU (23) sets the bit rate from the MPEG encoder to magnetic head (11) at 12 Mbps

S2 CPU (23) sends the state that the number of channels received is set at 3 to the controller

S3 Controller (5) selects MPEG encoders (6)-(8), and the MPEG compression rate for each of them is set at 4 Mbps

S4 The information of the selected 3 channels is sent through antenna (1) to tuners (2)-(4)

S5 The information sent to tuners (2)-(4) is compressed by MPEG encoders (6)-(8)

S6 The compressed data are sent to memory controller (9), and the data of the 3 channels are compiled to a series of data (see Figure 3)

S7 The sequence of data are sent to encoder (10), and error correction code is added and modulated

S8 The modulated data are sent through magnetic head (11) and optical pickup (14) and are recorded on magneto-optical disk (12)

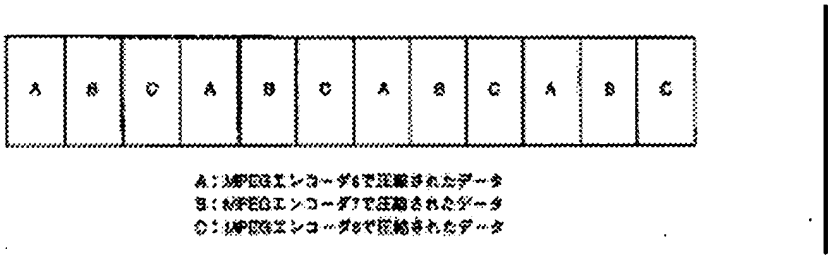

Figure 3

Key: A: Data compressed with MPEG encoder (6)
B: Data compressed with MPEG encoder (7)
C: Data compressed with MPEG encoder (8)

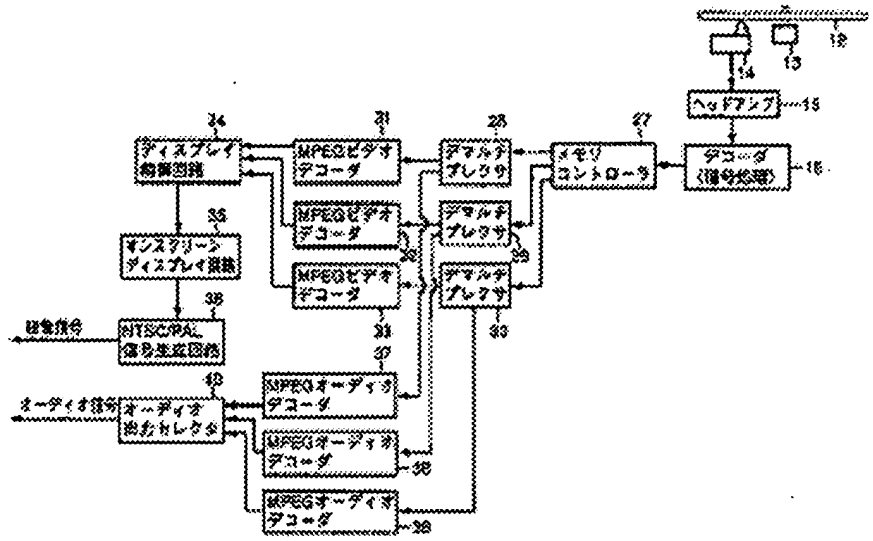

Figure 4

Key:
- a Video signal
- b Audio signal
- 15 Head amplifier
- 16 Decoder (signal processor)
- 27 Memory controller
- 28 Demultiplexer
- 29 Demultiplexer
- 30 Demultiplexer
- 31 MPEG video decoder
- 32 MPEG video decoder
- 33 MPEG video decoder
- 34 Display controller
- 35 On-screen display circuit
- 36 NTSC/PAL signal generator
- 37 MPEG audio decoder
- 38 MPEG audio decoder
- 39 MPEG audio decoder
- 40 Audio output selector